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Report to
VILLAGE OF MONSANTO, ILLINOIS
upon
CONVEYING OF STORM AND WASTE WATER FROM THE EXISTING VILLAGE PUMPING STATION TO THE PROPOSED CORPS OF ENGINEERS PUMPING STATION

March 5, 1965

Metcalf & Eddy
Engineers
Boston - New York - Palo Alto

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March 5, 1965

Leo Sauget, Esquire
Mayor, Village of Monsanto
East St. Louis
ILLINOIS

Dear Mayor Sauget:

In accordance with the agreement between the Village of Monsanto and Metcalf & Eddy, we submit herewith our report on three alternate methods for conveying storm and waste water from the existing Village Pumping Station to the proposed Corps of Engineers Pumping Station.

Very truly yours,

METCALF & EDDY

John S. Bethel, Jr.

John S. Bethel, Jr.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Scope

Three alternate methods of conveying storm and waste water from the existing Village Pumping Station to the proposed Corps of Engineers Pumping Station have been investigated as follows:

Plan 1 - Utilize the existing outfall and allow the forebay water surface elevation in the existing pumping station to be elevated, as required.

Plan 2 - Pumping, utilizing the existing pumping station and outfall.

Plan 3 - Utilize the existing outfall and construct additional connecting sewers so that the forebay water surface elevation of 394.0 is not exceeded.

Conclusions

Based upon the data compiled in our studies and investigations, we conclude that:

1. The existing outfall has hydraulic capacity for approximately 100 cfs. (cubic feet per second) flow without exceeding an elevation of 394.0 in the existing pumping station forebay, and with the arrangement of the proposed Corps of Engineers pumping station.

The existing outfall operates under open channel, gravity flow conditions up to approximately 50 cfs. and above this figure operates as a pressure conduit.

2. The proposed Corps pumping station has a capacity of 135 cfs. at low river stages (El. 393±) and 115 cfs. at high river stages (El. 432±) and is expandable to a capacity of 200 cfs. Thus, the present peak flow of 137 cfs. established by the Village of Monsanto cannot be pumped to the river by the proposed Corps station. The Corps has estimated present peak flows to be about 115 to 120 cfs. and believes that the proposed station capacity is adequate.
3. Flows up to approximately 125 cfs. can be accommodated while maintaining the existing pumping station forebay level below El. 394.0 by construction of two 42-in. vitrified-clay connecting sewers between the existing station and the proposed Corps Transition Chamber No. 2, and up to approximately 145 cfs. by construction of three 42-in. pipes, without pumping.
4. Under the pumping station arrangement proposed by the Corps of Engineers, future peak flows of 200 cfs. can only be accommodated by operation of the existing pumping station, if forebay levels are to be maintained below El. 394.0.

5. The structural condition of the older section of the existing pumping station and existing outfall is unknown at the present time. However, preliminary investigation of the existing pumping station indicates that this structure is in need of extensive renovation and repair if it is to be maintained in service and we expect the same is true of the existing outfall.
6. Continued use of the existing outfall at increased velocities necessitated by future peak flows may result in severe structural damage and possible rupture of the outfall. A minimum of two additional 42-in. pipes should be added for future 200 cfs. flows to prevent excessive velocities in the existing outfall. It is to be noted that the same conditions will exist in the section of the outfall between the proposed Corps pumping station and the river and that adequate provision should be made for construction of additional parallel outfall sewer lines.
7. A rupture of the existing outfall on the land side of the levee could result in extensive property damage.
8. If additional connecting sewers were constructed inspection and/or repairs on that section of the existing outfall which is to be retained in service could be accomplished.

Recommendations

1. Based upon the controlled water level elevations within the proposed Corps of Engineers pumping station and the Village requirement of not exceeding El. 394.0 in the existing pumping station forebay, we recommend that the existing pumping station and existing outfall be utilized to conduct present peak flows up to 137 cfs. to the proposed Corps of Engineers pumping station.

   Our studies indicate that flows up to approximately 100 cfs. can flow to the Corps station without pumping and still not exceed a forebay elevation of El. 394.0 at the existing station. Thus, it will only be necessary for the Village to start pumping when the flows exceed approximately 100 cfs.

2. We strongly recommend that consideration be given to relaxing the limitations imposed on us in this report, by further investigating the possibility of lowering the normal operating range at the Corps station even to the point of constructing a deeper station. Also, that the limitation of a maximum forebay water surface elevation of 394.0 in the existing station imposed on us by the Village be further investigated to consider whether or not this elevation could be raised.

3. We recommend that differential water levels between the existing pumping station surge chamber and the proposed Transition Chamber No. 2 be measured after the Corps station is constructed to determine friction losses in the existing outfall for use in determining required future reinforcements.
4. When peak flows in the sewer system are such that they exceed 137 cfs., we recommend the reinforcement of the existing outfall with twin 42-in. vitrified-clay sewers between the existing pumping station and Transition Chamber No. 2.
5. It is our understanding that the Village of Monsanto is undertaking comprehensive study of the sewerage system. In such a study we recommend that an analysis of previous reports be included and a final determination made of the capacity of the existing system and its expected peak flow rate. Also, that the conclusions and recommendations contained in this report be re-evaluated in light of the conclusions reached regarding the Village system and anticipated future flows.

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FROM THE EXISTING VILLAGE PUMPING STATION TO THE
PROPOSED CORPS OF ENGINEERS PUMPING STATION
FOR THE
VILLAGE OF MONSANTO, ILLINOIS

AUTHORIZATION

In accordance with agreements reached between the Village of Monsanto and Metcalf & Eddy on April 29, 1964, we have prepared a technical and economic engineering evaluation of various methods of conveying storm and waste water from the existing Village of Monsanto Pumping Station to the proposed Corps of Engineers Pumping Station. A complete account of our investigation together with our conclusions and recommendations is presented in the report which follows.

SCOPE

This report includes consideration of three alternate plans of conveying storm and waste water from the existing Village pumping station to the proposed Corps of Engineers Pumping Station. The three plans are:

Plan 1 - Utilize the existing outfall and allow the forebay water surface elevation in the existing pumping station to be raised.

Plan 2 - Pumping, utilizing the existing pumping station and outfall.

Plan 3 - Utilize the existing outfall, and construct additional connecting sewers so that the forebay water surface elevation of 394.0 is not exceeded.

GENERAL BACKGROUND AND DEVELOPMENT OF PROBLEM

The Village of Monsanto is served by a combined sewerage system which conveys storm and waste water to the Village pumping station and subsequently to the Mississippi River. During low river stages the waters flow by gravity through an existing 57-1/2-in. by 52-in. rectangular vitrified-clay lined reinforced concrete box sewer to the river. During high river stages the waters are pumped to the Mississippi utilizing the same concrete sewer and a surge chamber.

The waste waters discharged by the Village are extremely corrosive. Rapid deterioration of usual construction materials such as concrete and steel occurs when the materials are placed in contact with the waste or in the atmosphere of the wastes. Visual inspection of the existing pumping station indicates that substantial deterioration of the clay-lined concrete surfaces and steel crane rails have occurred.

Some time ago, an evaluation of the existing pumping station by the Corps of Engineers indicated that the station would not satisfy the design criteria established under the proposed Mississippi River flood control program standards.

The Corps has presently completed the design of a proposed pumping station located along the existing outfall on the river side of the levee. The Site Map, Fig. 1, indicates the general relationship of the Corps and existing Village pumping stations. If adequate additional connecting

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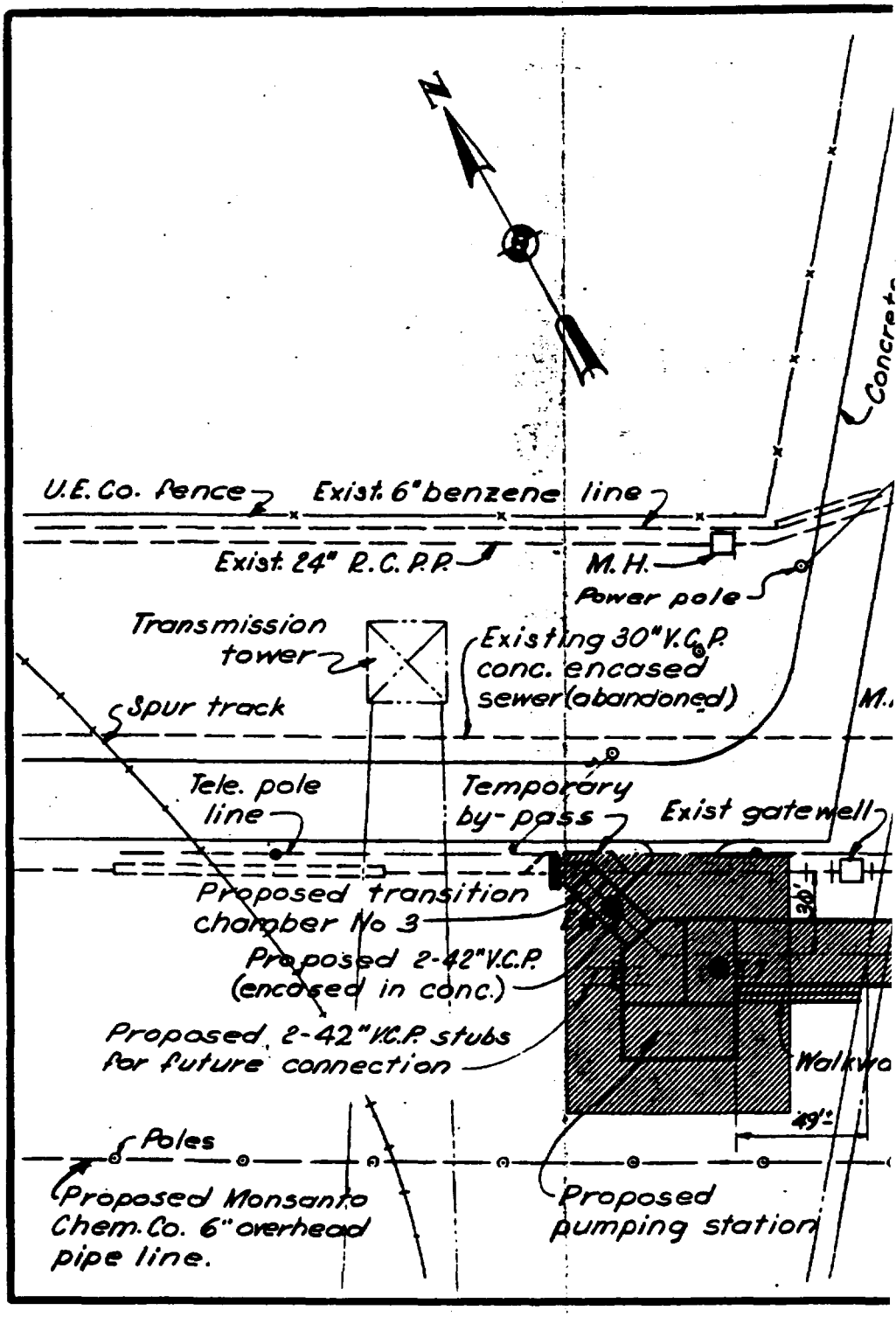

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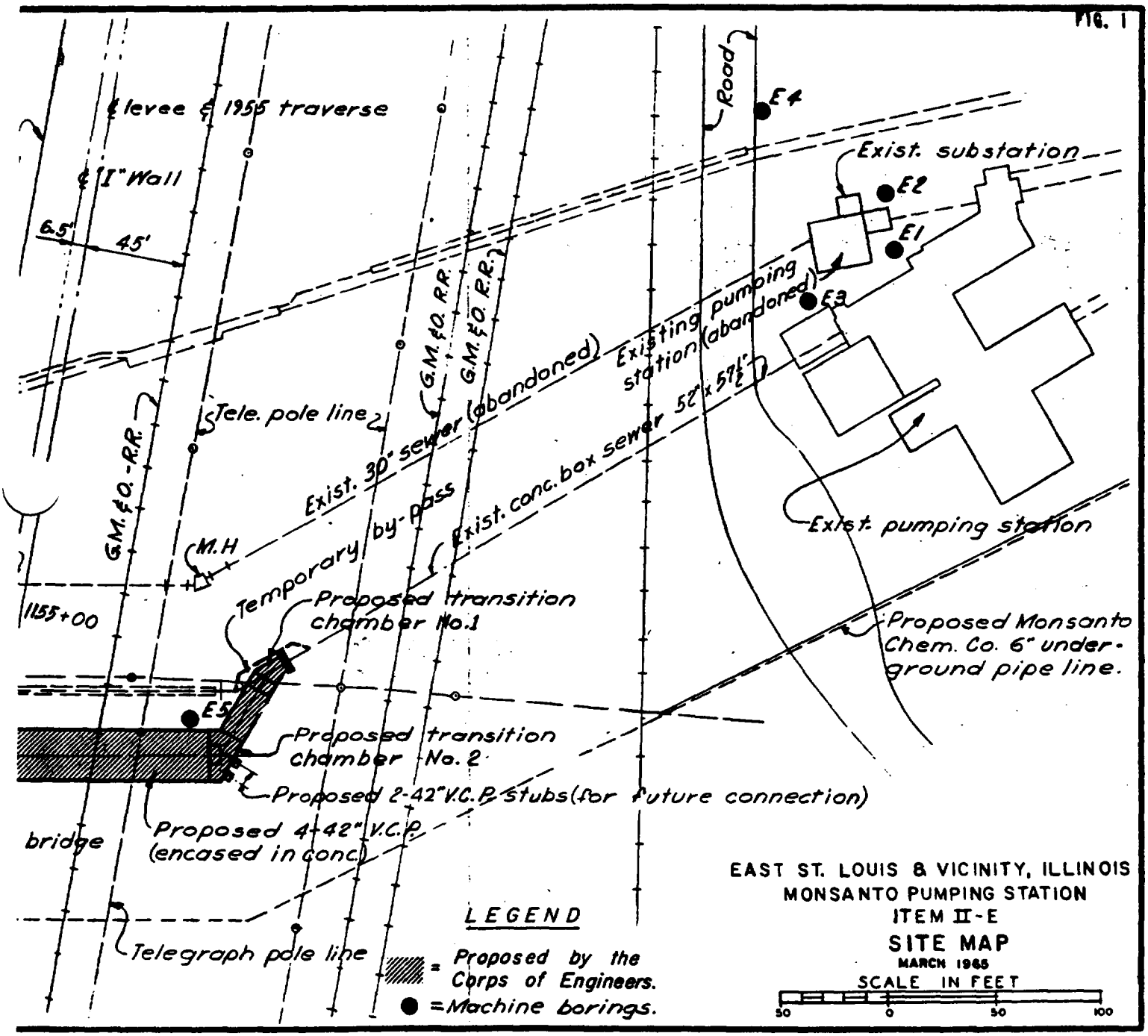


FIG. 1
℄ levee ℄ 1955 traverse
℄ "I" Wall
6.5'
45'
Road
E4
Exist. substation
E2
E1
E3
Existing pumping station (abandoned)
G.M.&O. R.R.
G.M.&O. R.R.
Tele. pole line
Exist. 30" sewer (abandoned)
Exist. conc. box sewer 52" x 57½"
M.H
Temporary by-pass
Exist. pumping station
1155+00
Proposed transition chamber No. 1
Proposed Monsanto Chem. Co. 6" underground pipe line.
E5
Proposed transition chamber No. 2
Proposed 2-42" V.C.P. stubs (for future connection)
bridge
Proposed 4-42" V.C.P. (encased in conc.)
Telegraph pole line
LEGEND
= Proposed by the Corps of Engineers.
= Machine borings.
EAST ST. LOUIS & VICINITY, ILLINOIS
MONSANTO PUMPING STATION
ITEM II-E
SITE MAP
MARCH 1965
SCALE IN FEET
50
0
50
100

sewers are connected between the stations, operation of the existing pumping station during present peak flows would be obviated while not exceeding a forebay water surface elevation of 394.0 Conversely, continued operation of the existing pumping station would obviate the construction of additional connecting sewers between the two stations under the same conditions.

The proposed Corps pumping station has been designed to presently handle a maximum flow of 115 cfs. at a high river stage of 52 feet and 135 cfs. at the gate closing stage of 13 feet (El. 393±).

The Village of Monsanto has recently had detailed plans and specifications prepared for waste treatment facilities by Metcalf & Eddy, Engineers. Construction bids for the facilities were received on December 8, 1964 and a contract for construction signed on February 4, 1965. Prior to the construction of the Corps of Engineers Pumping Station, the existing pumping station would be used for pumping waste water to the proposed treatment facilities and waste and stormwater to the Mississippi River during certain periods of high river stages.

The Village of Monsanto has established that combined peak storm and waste flows of approximately 137 cfs. (present conditions) and 200 cfs. (future design conditions) would be conveyed from the existing pumping station to the proposed

Corps of Engineers Pumping Station. The existing 57-1/2-in. by 52-in. outfall does not have the hydraulic capacity for these flows under open channel, gravity flow conditions. The hydraulic capacity of the existing outfall under open channel, gravity flow conditions would be approximately 50 cfs. If flows in excess of 50 cfs. are passed through the existing outfall it becomes a pressure conduit.

PREVIOUS REPORTS

Three engineering studies have been prepared relative to the evaluation and development of the Village of Monsanto sewer system. Metcalf & Eddy's initial report for the Village of Monsanto titled "Report Upon Waste Water Treatment for the Village of Monsanto, Illinois," dated November 3, 1960 recommended supplementary sewerage facilities in order to effect separation of phenol and acid waste streams.

Following the initial Metcalf & Eddy report, a report was prepared by Joseph W. Goldenberg, Consulting Engineer, titled "Report Upon Separation of Sewers in the Village of Monsanto, Monsanto, Illinois, for Monsanto Chemical Company," dated March 15, 1962. This report presented an engineering and economic evaluation of alternate methods for separation of storm and waste water sewers.

A report dated December 10, 1962 and titled "Sewer Study - Monsanto Village, Illinois, (P.S. No. 96)" was prepared by Monsanto Company, Engineering Department, Organic Chemical Division. This report was a hydraulic evaluation of the adequacy of the present Village sewer system.

One of the major conclusions contained in this latter report was that "The present system is adequate for runoff rates up to 1.0 cfs. per acre when operated as a pressure system using present surge pond facilities. This runoff rate is considered adequate for the present." This evaluation was based upon maintaining the water surface elevation in the forebay of the Village pumping station below El. 394.0

during maximum flows. A review of the hydraulic profiles contained within the Monsanto report indicates that the pipe frictional coefficient used in the preparation of this report was approximately an "n" value of 0.010. This frictional coefficient is below the usual standard engineering values for vitrified-clay sewers of n = 0.013 and n = 0.015. Frictional coefficients of 0.013 and 0.015 were used by Joseph W. Goldenberg in the preparation of his report and in our opinion are the values which should be used. This variation of frictional coefficients used could significantly modify the conclusions contained within the Monsanto Company report.

The total flow to the Village pumping station during periods of runoff of 1.0 cfs. per acre was determined in the Monsanto report as 137 cfs., and is used as the basis of design as indicated hereinafter. However, it should be noted that, if based on the recommended "n" values noted above, the calculated runoff at 1.0 cfs. per acre would be reduced to about 110 cfs.

In addition to the above reports, the U.S. Army Corps of Engineers evaluated the expected runoff from the existing system prior to their design of the proposed pumping station and estimated a peak runoff rate of approximately 120 cfs.

Representatives of the Monsanto Company have indicated, based on their above studies, that not exceeding a forebay

elevation of 394.0 in the existing station is critical to prevent flooding of plant facilities. A preliminary review of this Monsanto report indicates that on the basis of the flows indicated therein, flooding of the present sewer system would occur even if the forebay water surface of 394.0 is not exceeded. Because of the differences noted above, we believe that an evaluation of the aforementioned engineering studies should be undertaken.

DESCRIPTION AND EVALUATION OF EXISTING PUMPING STATION AND OUTFALL SEWER

The existing pumping station shown on Fig. 2 consists of two interconnected pumping stations each having three pumps, a surge chamber and wooden bar racks. The interior concrete surfaces which are usually in contact with the wastes are lined with vitrified-clay liner plates. The pumping station was constructed in two stages. The older section of the pumping station was constructed about 1942 and the newer section was constructed about 1952. The existing 57-1/2-in. by 52-in. vitrified-clay lined concrete outfall was also constructed about 1942.

The condition of the existing pumping station and outfall sewer is unknown at the present time. Visual inspection of the walls above the liquid level of the pumping station indicates that a number of clay liner plates have fallen off and that the wastes have attacked the underlying concrete. The condition of the interior walls and floor below the liquid level is unknown; however, a prudent estimate would be that the condition below the liquid level is worse due to the severity of the environment. The actual condition of the underlying concrete both above and below the liquid level is unknown. The older section of the pumping station appears to be more seriously deteriorated than the newer section.

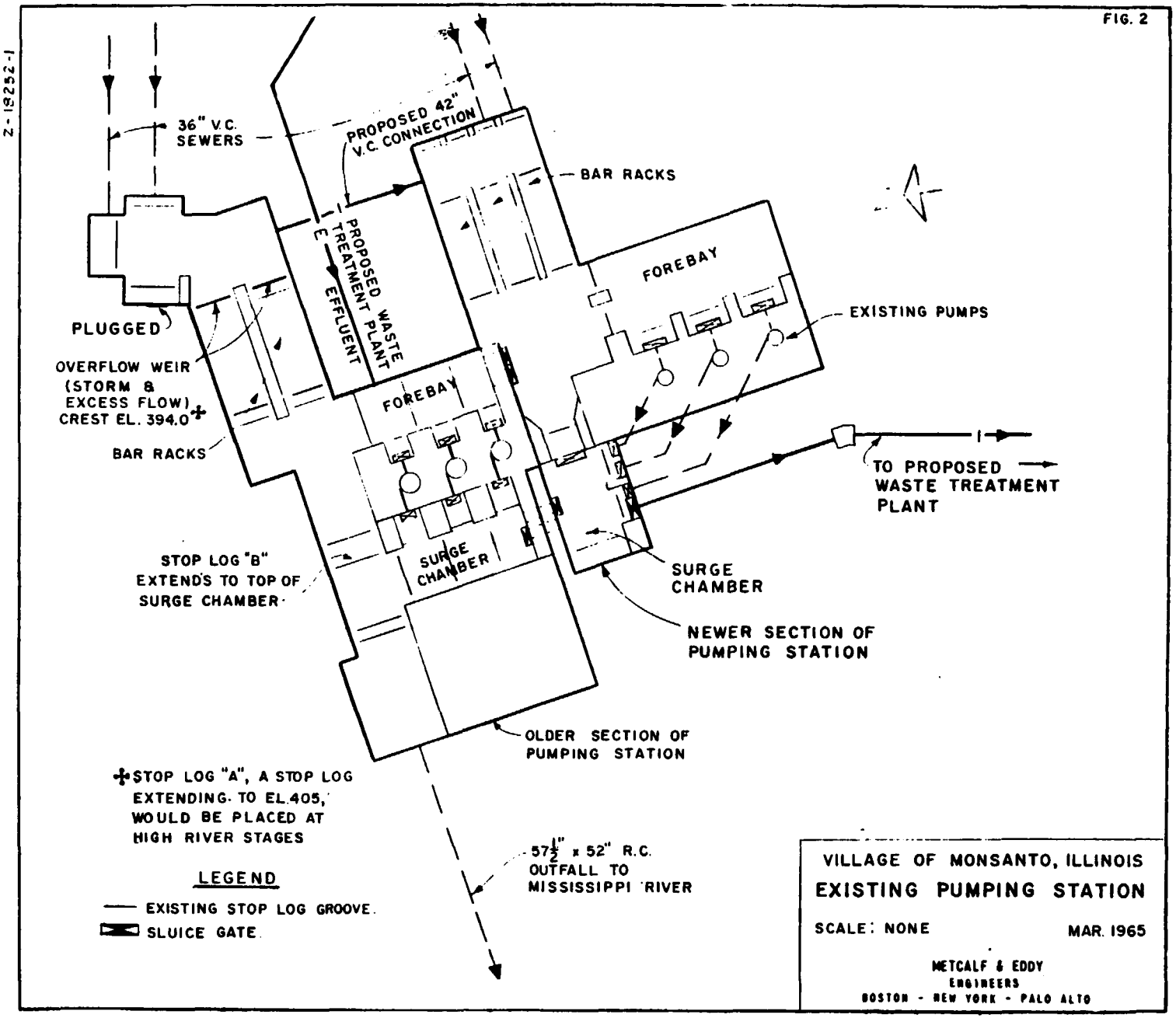


FIG. 2
Z-18252-1
36" V.C. SEWERS
PROPOSED 42" V.C. CONNECTION
BAR RACKS
PROPOSED WASTE TREATMENT PLANT
EFFLUENT
FOREBAY
EXISTING PUMPS
PLUGGED
OVERFLOW WEIR (STORM & EXCESS FLOW) CREST EL. 394.0 ✣
BAR RACKS
FOREBAY
TO PROPOSED WASTE TREATMENT PLANT
STOP LOG "B" EXTENDS TO TOP OF SURGE CHAMBER
SURGE CHAMBER
SURGE CHAMBER
NEWER SECTION OF PUMPING STATION
OLDER SECTION OF PUMPING STATION
✣ STOP LOG "A", A STOP LOG EXTENDING TO EL. 405, WOULD BE PLACED AT HIGH RIVER STAGES
57½" x 52" R.C. OUTFALL TO MISSISSIPPI RIVER
LEGEND
EXISTING STOP LOG GROOVE
SLUICE GATE
VILLAGE OF MONSANTO, ILLINOIS
EXISTING PUMPING STATION
SCALE: NONE
MAR. 1965
METCALF & EDDY
ENGINEERS
BOSTON - NEW YORK - PALO ALTO

Corrosion tests carried out by the Monsanto Company, indicated that concrete is subject to severe attack by the wastes.

The condition of the existing outfall is also unknown. At the present time, it is impossible to bypass the dry weather flow around the existing outfall in order to inspect or repair the interior.

In conjunction with the design of the proposed pumping station, an evaluation of the existing pumping station was prepared by the Corps of Engineers. The Corps engaged the services of Lawrence E. Stout, Professional Engineer, Washington University, and a letter dated September 10, 1958 was submitted to the Corps by Mr. Stout. An excerpt of his letter regarding the condition of the existing pumps and pumping station follows:

> "...Exposed metal parts are subject to severe airborne corrosion primarily from sulphur dioxide pollution of the atmosphere from the fluid handled by the pumps. In numerous areas the ceramic tile have loosened and exposed bare concrete to the corrosive liquors handled by the system.
>
> "...Two of the pumps were inspected (after the impeller had been pulled) and each showed marked indications of electrolytic corrosion. Pump No. 5 is alleged to have been in service 3 to 3-1/2 years

and is still usable although already showing that the volute is suffering anodic corrosion and resultant solution. Pump No. 1 is alleged to have been in service 6-1/2 years and the volute is so badly corroded that it should be replaced entirely."

In summary, the condition of both the pumping station and outfall are unknown. However, present indications are that considerable deterioration of the pumping station has occurred and we would expect the same to be true of the outfall. The older section of the pumping station and the outfall probably have deteriorated to a greater extent.

BASIC DESIGN DATA

The basic design data used in the preparation of this report is shown below. The combined flows have been established by the Village of Monsanto.

Present combined peak storm and waste flow, cfs.	137
Future combined peak flow, cfs.	200
Maximum combined flow to the waste treatment facilities under normal operating conditions, cfs. (based on operation of 3 newer pumps)	78
Existing outfall sewer:	
Size, in.	57-1/2 by 52
Material	Vitrified-clay lined, reinforced concrete
Slope, ft./ft.	0.0005
Assumed frictional coefficient, Mannings	n=0.015
Proposed 42-in. vitrified-clay sewers:	
Assumed frictional coefficient, Mannings	n=0.013

We have conferred with the Corps of Engineers regarding the water surface elevation at the proposed pumping station. The Corps has designed the proposed pumping station to operate between elevations 389.85 and 392.85

depending upon the flow and number of pumps in operation. Provision has been made for replacement of the pumps with units capable of handling the future 200 cfs. combined flow. Thus, it should be noted that at high river stages, based on the proposed design capacity noted hereinbefore, the proposed Corps pumping station cannot handle the present peak flow of 137 cfs. used in this report.

DESCRIPTION OF ALTERNATE PLANS

Three alternate methods were considered for conveying the storm and waste water from the existing Village pumping station to the proposed Corps of Engineers Pumping Station as follows:

Plan 1 - Utilize the existing outfall and allow the forebay water surface elevation in the existing pumping station to be elevated as required.

Plan 2 - Pumping, utilizing the existing pumping station and outfall.

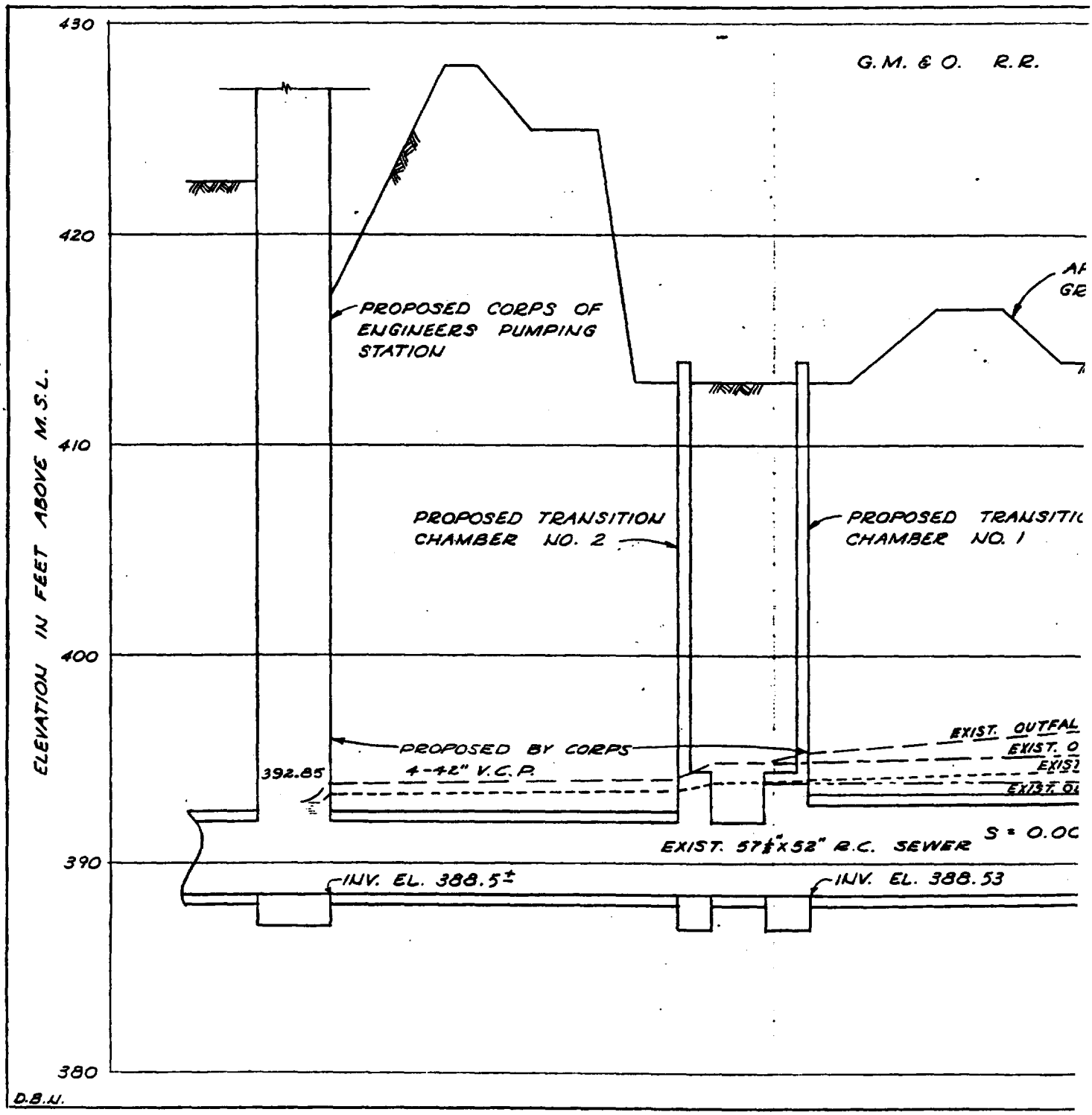
Plan 3 - Utilize the existing outfall and construct additional connecting sewers so that the forebay water surface elevation of 394.0 is not exceeded.

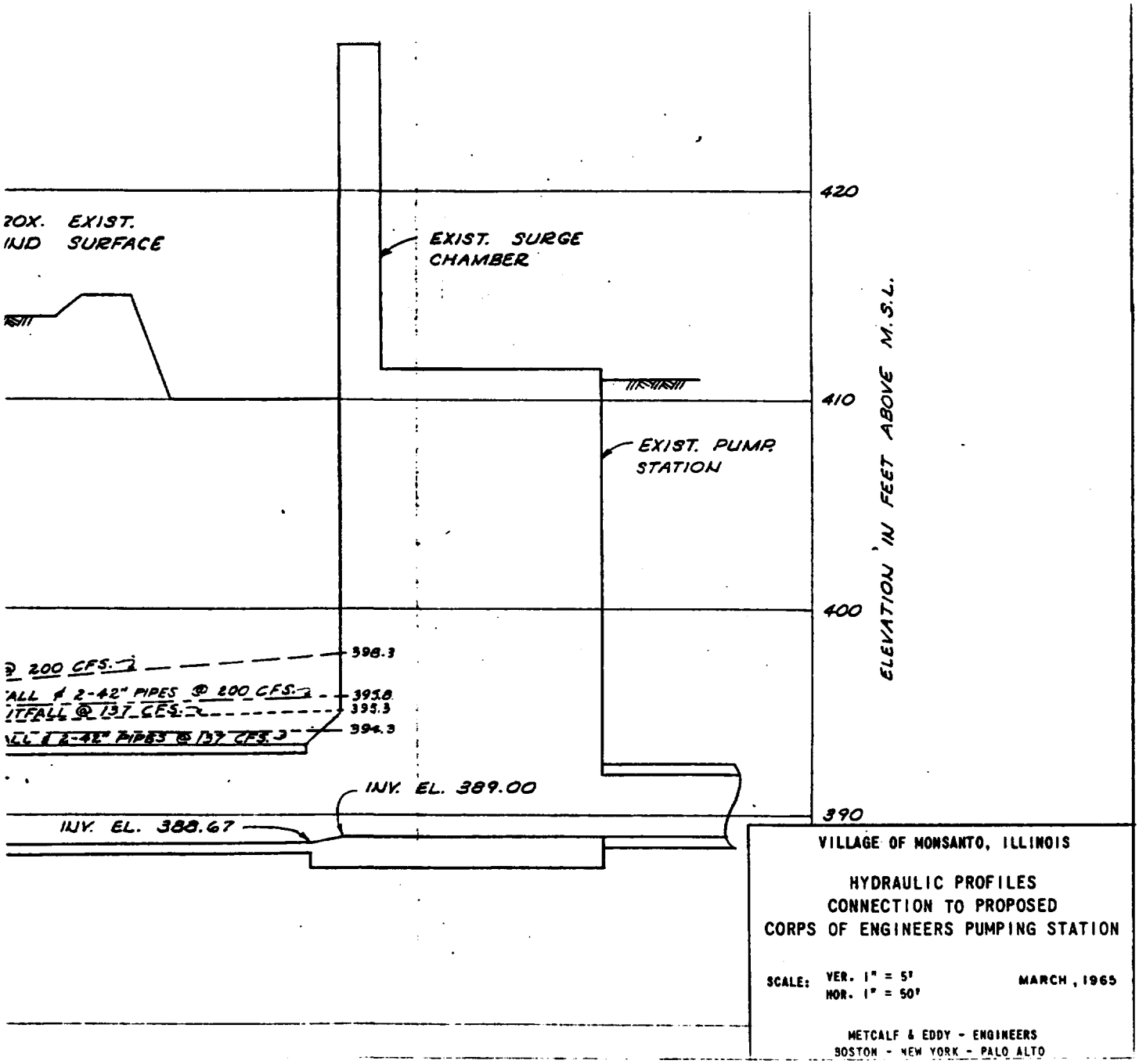
The evaluation of each of these plans should be made considering that the conditions and flows being considered may occur once in five years for a duration of an hour or less.

The following is a discussion of the features of the three plans based on a maximum water surface elevation of 392.85 in the suction chamber of the proposed pumping station. The hydraulic profiles of each plan are presented in Fig. 3.

Plan 1. Utilize the Existing Outfall and Allow The Elevation In The Existing Pumping Station To Be Elevated as Required

This plan would require the existing forebay water surface elevation to be increased to approximately El. 398.3


430
420
410
400
390
380
ELEVATION IN FEET ABOVE M.S.L.
G.M. & O. R.R.
PROPOSED CORPS OF ENGINEERS PUMPING STATION
PROPOSED TRANSITION CHAMBER NO. 2
PROPOSED TRANSITIO CHAMBER NO. 1
PROPOSED BY CORPS 4-42" V.C.P.
392.85
EXIST. OUTFAL
EXIST. O
EXIST
EXIST. OU
EXIST. 57"x52" R.C. SEWER
S = 0.00
INV. EL. 388.5±
INV. EL. 388.53
D.B.J.



VILLAGE OF MONSANTO, ILLINOIS

HYDRAULIC PROFILES
CONNECTION TO PROPOSED
CORPS OF ENGINEERS PUMPING STATION

SCALE: VER. 1" = 5'
HOR. 1" = 50'

MARCH, 1965

METCALF & EDDY - ENGINEERS
BOSTON - NEW YORK - PALO ALTO

in order to provide capacity for 200 cfs. and to approximately El. 395.3 to provide capacity for 137 cfs. The velocity through the outfall at 200 cfs. would be approximately 10 fps. (feet per second). The velocity at 137 cfs. would be approximately 6.5 fps. The existing outfall could provide capacity for approximately 100 cfs. combined flow without elevating the water surface elevation of the existing pumping station forebay above El. 394.0.

The advantages of this plan would be:

1. Minimal (if any) initial expenditure.
2. Minimal (if any) annual operating or maintenance cost.

The disadvantages would be:

1. High scouring velocities of approximately 10 fps. would be attained in the existing outfall during flows of 200 cfs. and could promote loosening or removal of the existing clay liner plates and subsequent structural damage to the concrete sewer.
2. Inspection or repair of the section of the existing outfall on the land side of the levee, which would be retained in service, would not be possible during dry weather flow.
3. Extensive parallel relief sewers would have to be added to the existing combined sewer system to prevent severe flooding during the

storms upon which the design flows in this report are based. As previously indicated, the forebay water surface elevation in the existing pumping station will vary between El. 395.3 and El. 398.3 for flows from 137 cfs. to 200 cfs., respectively.

Plan 2. Pumping Utilizing The Existing Pumping Station and Outfall

Representatives of the Monsanto Company have suggested that, since a method of conveying stormwater to the Corps of Engineers station is being sought, consideration be given to retaining the older section of the pumping station in operation for pumping storm and waste water to the proposed Corps of Engineers Pumping Station.

Under this plan flows up to approximately 100 cfs. would flow to the proposed Corps pumping station without pumping and flows in excess of this figure would be pumped. We wish to emphasize that this 100 cfs. figure is dictated by the physical arrangement of the Corps of Engineers pumping station and the requirement of the Village for not exceeding forebay levels of El. 394.0. Any relaxation of these present limitations would result in less pumping.

This plan would allow present peak flows up to 137 cfs. to be conducted to the proposed Corps of Engineers pumping station without constructing additional reinforcing sewers between the two stations and without exceeding El. 394.0 in the existing station forebay and at velocities less than

6.5 fps. Future peak flows of 200 cfs. would require the construction of additional connecting sewers to prevent excessive velocities and allow inspection and repair of the existing outfall.

The advantages of this plan are:

1. The initial cost of this plan would be less than that of construction of additional connecting sewers.
2. It is the only plan which can be utilized for present and future flows while not exceeding the pumping station elevations set by the Village and the Corps of Engineers.

The disadvantages would be:

1. The initial cost would be higher than utilizing the existing outfall and allowing the forebay water surface elevation to be increased.
2. Inspection or repair of the section of the existing outfall on the river side of the levee which would be retained in service would not be possible during dry weather flow.
3. High scouring velocities would be attained in the existing outfall which would promote loosening or removal of the existing clay liner plate and subsequent structural damage to the concrete sewer.

4. The older section of the existing pumping station would be retained in service requiring additional acid resistant linings.
5. The older existing pumps would be retained in service requiring additional annual maintetance, parts and/or pump replacement.
6. Annual power costs would also be incurred.

Plan 3. Construction of Additional Connecting Sewers

The object of this plan would be to parallel the existing outfall with additional sewers constructed between the existing station and proposed Transition Chamber No. 2 in order to eliminate pumping and allow maintenance of the existing outfall. Based on the design water levels at the proposed station and not exceeding El. 394.0 at the existing station, twin 42-in. vitrified-clay sewers utilized in conjunction with the existing outfall would increase gravity-flow capacity to approximately 125 cfs. while three additional 42-in. lines would increase capacity to about 145 cfs. However, because of the configuration of the proposed pumping station, our studies indicate no amount of additional lines between the existing station and Transition Chamber No. 2 will permit 200 cfs. to flow between the two stations without pumping and without exceeding present water surface limitations at the proposed and existing stations.

Consequently, it is our opinion that the construction of three additional 42-in. lines to handle 137 cfs. without pumping is an uneconomical solution if pumping at 200 cfs. will eventually be required. The construction of two 42-in. lines will provide sufficient capacity without the necessity of pumping at all but the most extreme present design flows (in excess of 125 cfs.) and will fit into the handling of future peak flows by pumping.

Thus, if the present design water surface requirements at the existing and proposed stations are not to be altered, the use of both Plan 2 and Plan 3 will eventually be required to handle future 200 cfs. flows without producing excessive outfall velocities. However, it should be noted that if a decision is reached that the future 200 cfs. condition is unrealistic the construction of three 42-in. lines to eliminate pumping to the Corps station may be desirable, in that as noted above, the three 42-in. lines can handle a gravity flow of approximately 145 cfs. If reinforced by twin 42-in. pipelines, the velocities in the outfall would be approximately 3.5 fps. for a flow of 137 cfs., and 5.0 fps. for a flow of 200 cfs. and would be correspondently lower if three 42-in. pipelines were installed.

The advantages of this plan would be:

1. Inspection and repair of the section of the existing outfall on the land side of the levee, which would be retained in service, would be possible during periods of dry weather flow.

2. Velocities in the existing outfall would be lower thereby reducing the possibility of clay liner plates being removed by scouring action, and the subsequent possibility of structural damage to the concrete.

The disadvantages of the plan would be:

1. Capital and annual costs would exceed those of pumping.
2. It would not eliminate pumping at future 200 cfs. peak design flows.

As discussed previously, the addition of two or three 42-in. connecting pipelines would permit the handling of flows of approximately 125 cfs. and 145 cfs., respectively without pumping. Flows in excess of these values would require pumping.

Table 1. Economic Comparison of Alternate Plans[1]

Plan 1 - Utilize the existing outfall and allow the forebay water surface elevation in the existing pumping station to be elevated, as required.

No initial expenditure would be required for this plan; however, the cost of maintenance of the existing outfall at the high velocities to be encountered in this plan is unknown.

Plan 2 - Pumping, utilizing existing pumping station and outfall up to peak flows of 137 cfs. (initial cost).

Capital Costs

Item	Estimated Cost[1]
Additional structural repair[2]	$20,000
Additional polyester linings	10,000
Pump replacement (3 older pumps)	40,000
Modification of power service facilities	4,500
Estimated Construction Cost	$74,500
Contingencies & Engineering	18,500
Total Estimated Capital Cost	$93,000

Annual Costs

Debt service[3]	$ 6,500
Power	500
Annual maintenance of older section of pump station	500
Total Estimated Annual Cost[4]	$ 7,500

Table 1 (cont.). Economic Comparison of Alternate Plans[1]

Plan 3 - Construction of Additional Connecting Sewers.

A. Construction of two 42-in. vitrified-clay sewers to reinforce and allow inspection of the existing outfall and permit pumping of future 200 cfs. flows.

Capital Costs

Item	Estimated Costs
Two 42-in. diameter vitrified-clay concrete encased connecting sewers	$110,000
Estimated Construction Cost	$110,000
Contingencies & Engineering	25,000
Total Estimated Capital Cost	$135,000

Annual Costs

Debt service[3]	$ 9,500
Total Estimated Annual Cost	$ 9,500

B. Construction of three 42-in. connecting sewers in the event that future flows above 145 cfs. no longer appear realistic.

Capital Costs

Item	Estimated Costs
Three 42-in. diameter vitrified-clay concrete encased connecting sewers	$150,000
Estimated Construction Cost	$150,000
Contingencies and Engineering	35,000
Total Estimated Capital Cost	$185,000

Table 1 (cont.). Economic Comparison of Alternate Plans[1]

Annual Costs

Item	Estimated Costs
Debt Service[3]	$13,000
Total Estimated Annual Cost	$13,000

1. The cost estimates used in this report are based upon cost levels corresponding to an ENR Construction Cost Index of 1150.

2. The extent of structural rehabilitation and repair required in the existing pumping station is unknown at the present time. The costs of structural repair and rehabilitation could be much more extensive than indicated.

3. Based on a bond issue of 3-1/2 percent, 20 years.

4. Additional annual maintenance cost of the existing outfall at the velocities to be encountered in this plan is unknown.

ACKNOWLEDGMENT

We wish to express our appreciation to Mayor Sauget, the Village Board, Mr. Joseph W. Goldenberg, Village Engineer, and representatives of the various industries for their cooperation and assistance in the preparation of this report.

Respectfully submitted,

METCALF & EDDY

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APPENDIX A

Appendix A. Suggested Method of Pump Station Operation

At the present time, the existing pumping station is used to pump storm and waste water to the river during high river stages. When the waste treatment facilities are completed the operation of the existing pumping station would be modified and the pumping station would also be used to pump wastes to the treatment facilities. When the Corps of Engineers pumping station is completed and/or secondary treatment of the wastes are required, further changes in the operation of the existing pumping station would be required.

The following suggested method of pumping station operation would be applicable during the operating conditions indicated.

Operating Condition 1

a. Prior to completion of Corps of Engineers pumping station.

b. Primary waste water treatment facilities only.

c. Maximum waste flow, 36 mgd.

d. The pumping station forebay water surface elevation for the sewer system maintained at El. 394.*

Normal River Stages. During normal river stages (up to river El. 392.5±) and normal operating conditions at the waste treatment plant, flows up to approximately 78 cfs. (51 mgd.) could flow to the newer section of the pumping

*Note: River stage 10 is approximately El. 390.

At the present, during dry weather flow and high river a loss of approximately 1.5 ft. occurs in the existing outfall.

station and be pumped to the treatment plant. No stop logs would be placed. All flow to the river would be by gravity. If a maximum storm (five year frequency) occurred during this time, the overflow weir could be removed, if required.

High River Stages (River El. 392.5 and higher). During high river stages (river El. 392.5 to El. 403.5) and dry weather flow, stop log "A" (see Fig. 2) would be placed and extend up to El. 405. This is the maximum surcharge elevation which may be tolerated in order to provide at least primary treatment for the wastes. This will prevent the normal operation of the overflow weirs, and a part of the forebay and surge chamber of the older section of the pumping station would be surcharged. The dry weather flow would be pumped to the treatment plant and would flow by gravity to the river.

If a storm occurs at this time, up to 78 cfs. (51 mgd.) may be pumped to the treatment plant, under normal operating conditions.

When a major storm occurs (approximately once per month for four months) causing the flow to exceed 78 cfs., or when the river elevation exceeds El. 403.5 (approximately a duration of 28 days per year) stop log "A" and the overflow weir would be removed; the influent to the treatment plant would be closed; the sluice gates interconnecting the older and newer portions of the station would be open; the older pumps would be started; the newer pumps would be converted to storm operation; and after the pumps are operating, stop log "B" would be placed.

A high level alarm would be installed in the forebay of the newer section of the pumping station at El. 394.5 to indicate forebay elevations in excess of El. 394. A high level alarm actuated at El. 404 would also be installed in the forebay of the older section of the pumping station to warn of surcharging the plant effluent line.

Operating Condition 2

a. Corps of Engineers pumping station completed.

b. Maximum waste flow, 36 mgd.

c. The pumping station forebay water surface maintained at El. 394 or less.

Normal River Stages. During normal stages the operation would be the same as previously described under Operating Condition 1 for normal river stages.

High River Stages (above river El. 392.5). During high river stages the Corps of Engineers station would be placed in operation to pump flow to the river.

If a storm occurs at this time, up to 78 cfs. (51 mgd.) would be pumped to the treatment plant under normal operating conditions while the remainder overflowed to the Corps station.

When a major storm occurs (above 100 cfs. combined flow) it would be necessary to use the existing Village pumping station to pump to the Corps station in order not to exceed El. 394.0 at the Village station. It would then be

necessary to close the influent to the treatment plant and open the sluice gates interconnecting the forebays and surge chambers of the older and newer sections of the Village station. The three newer pumps and as many older pumps as required to handle the entire flow would operate. Stop log "B" would be placed when all required pumps reached speed.

A high level alarm set at El. 394.5 in the forebay of the newer section of the pumping station would be actuated to warn of excessive liquid levels.